Title: Gravitational Wave Telescopes: Some Cosmological Considerations

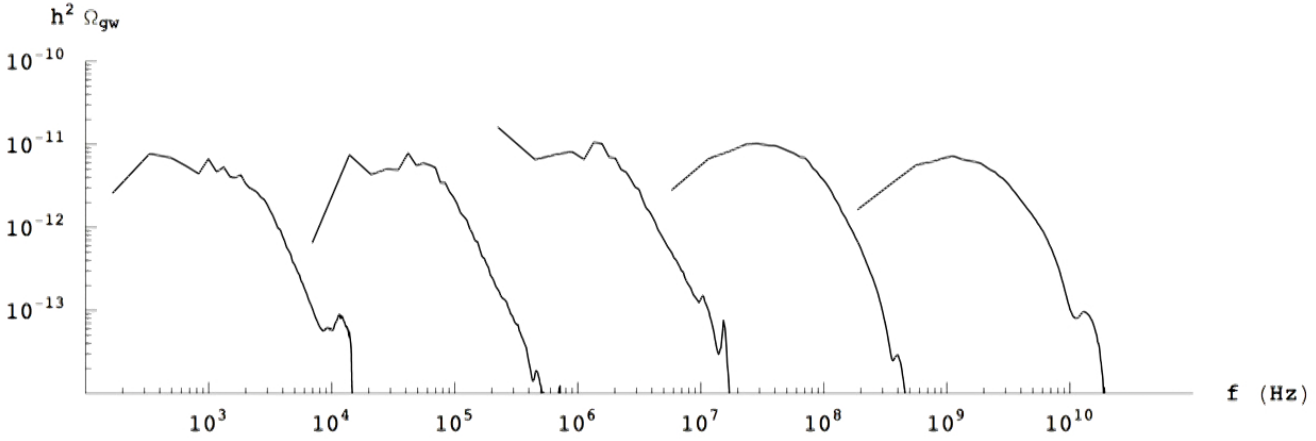
Date: Jun 12, 2018 09:00 AM

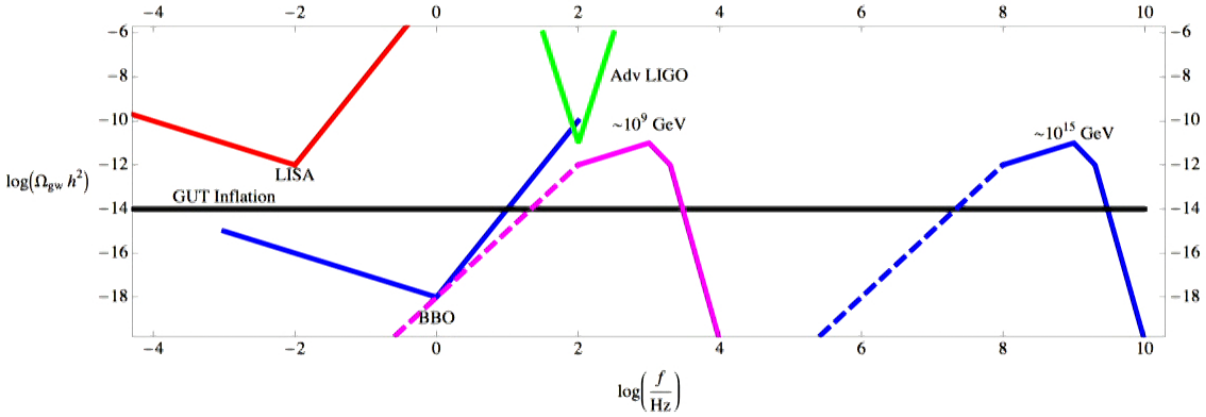
URL: http://pirsa.org/18060050

Abstract:

kHz Gravitational Waves from inflation?

kHz Gravitational Waves from "Preheating" after inflation?





figures R. Easther, J.T. Giblin and E. Lim, PRL (astro-ph/0612294)

kHz Gravitational Waves from Phase Transition?

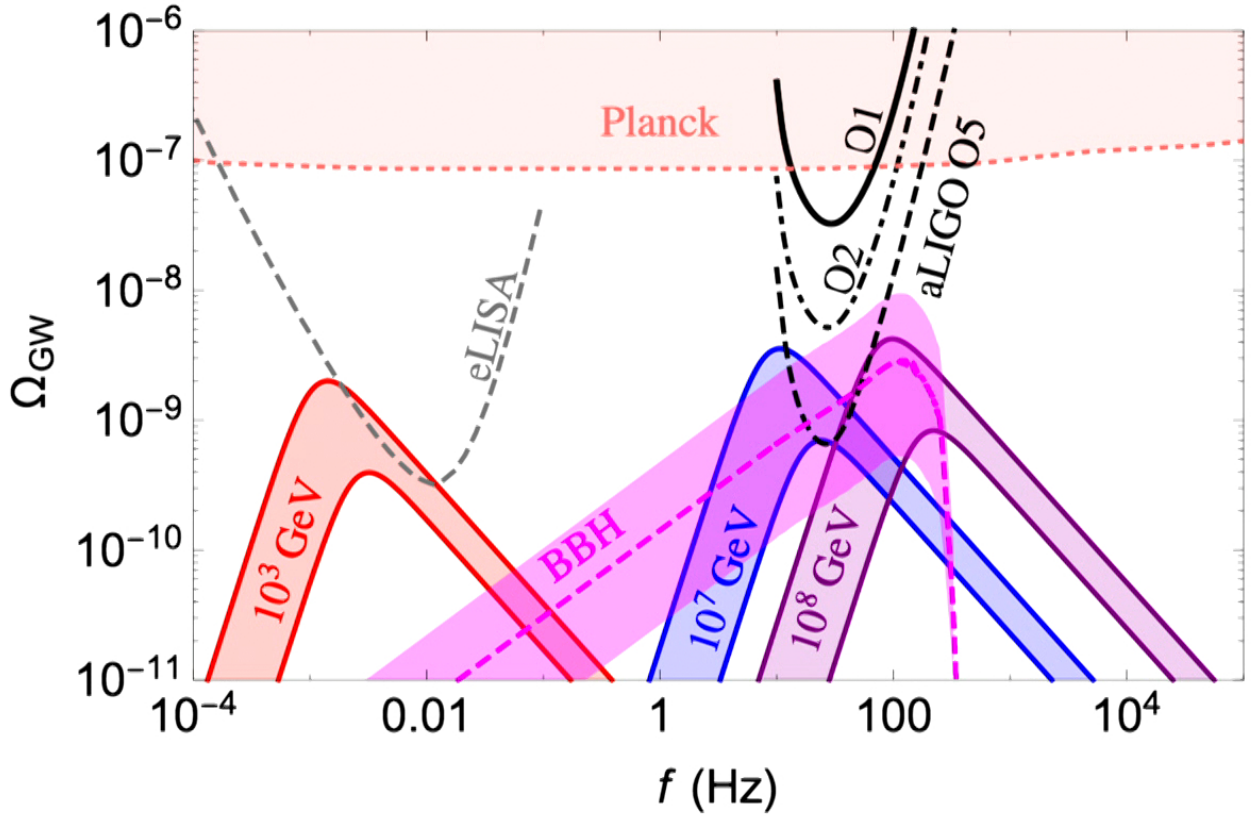


Figure from P.S. Bhupal Dev and A. Mazumdar, PRD (arXiv:1602.04203)

2 possible phase transitions:

B-L breaking (neutrinos):

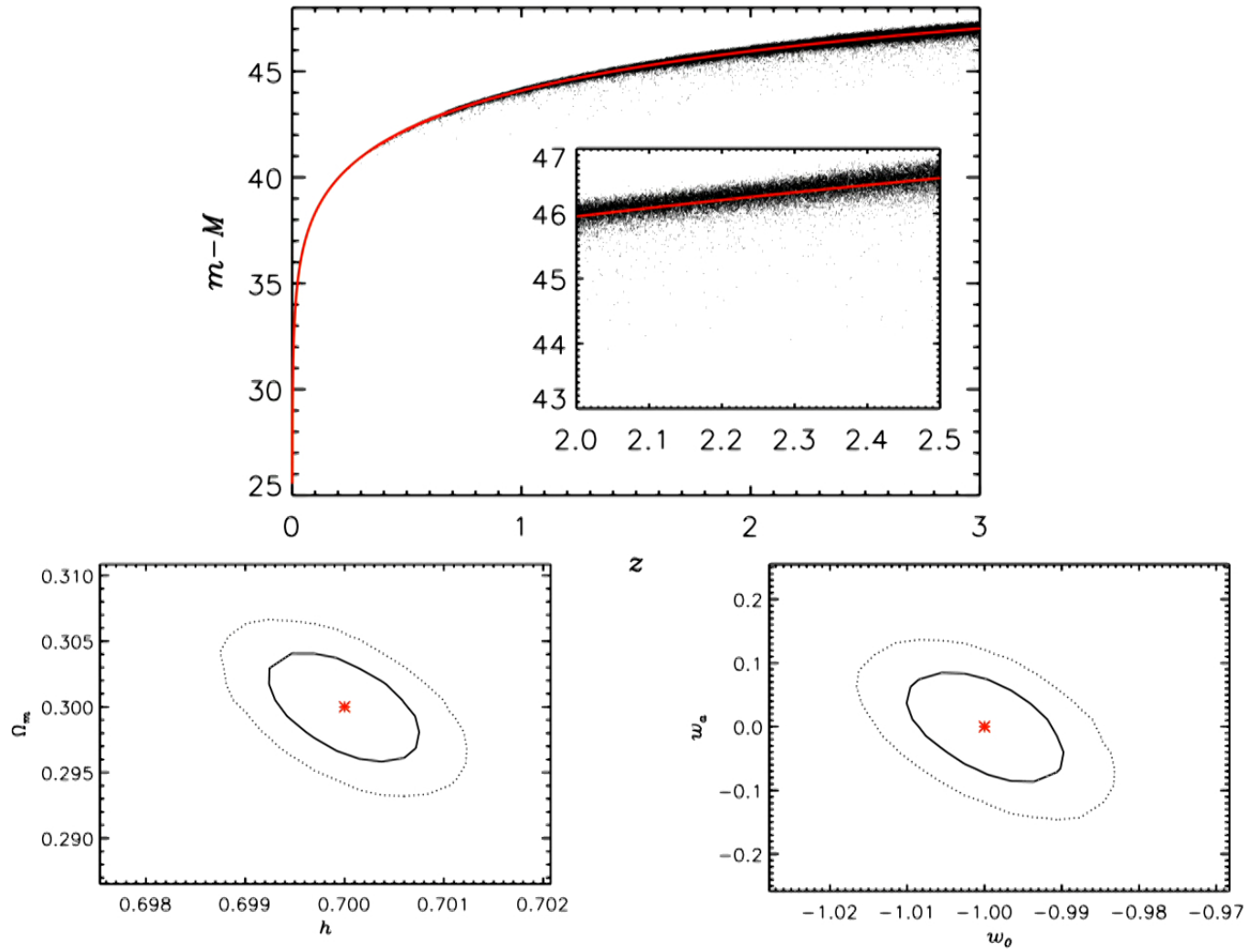
$$m_\nu = \frac{m_d^2}{m_m} = \frac{y_d^2 \langle h \rangle^2}{y_m \langle \varphi \rangle}$$

$$\langle \varphi \rangle \approx \frac{y_d^2}{y_m} \times 10^{15}\ \mathrm{GeV}$$

PQ breaking (axions):

$$\Omega_a h^2 \approx (m_a / 10^{-5}\ \mathrm{eV})^{-1.18}$$

$$f_{PQ} \approx \left(\frac{\mathrm{eV}}{m_a}\right) 5 \times 10^6\ \mathrm{GeV} \approx 5 \times 10^{10}\ \mathrm{GeV}$$



(figures from C. Cutler and D. Holz, arXiv:0906.3752)

$$s^{\alpha} = W^{\alpha}_{ij} h^{ij}$$

$$(W^{\alpha}_{ij} \propto p^{\alpha}_{i} p^{\alpha}_{j} - q^{\alpha}_{i} q^{\alpha}_{j})$$

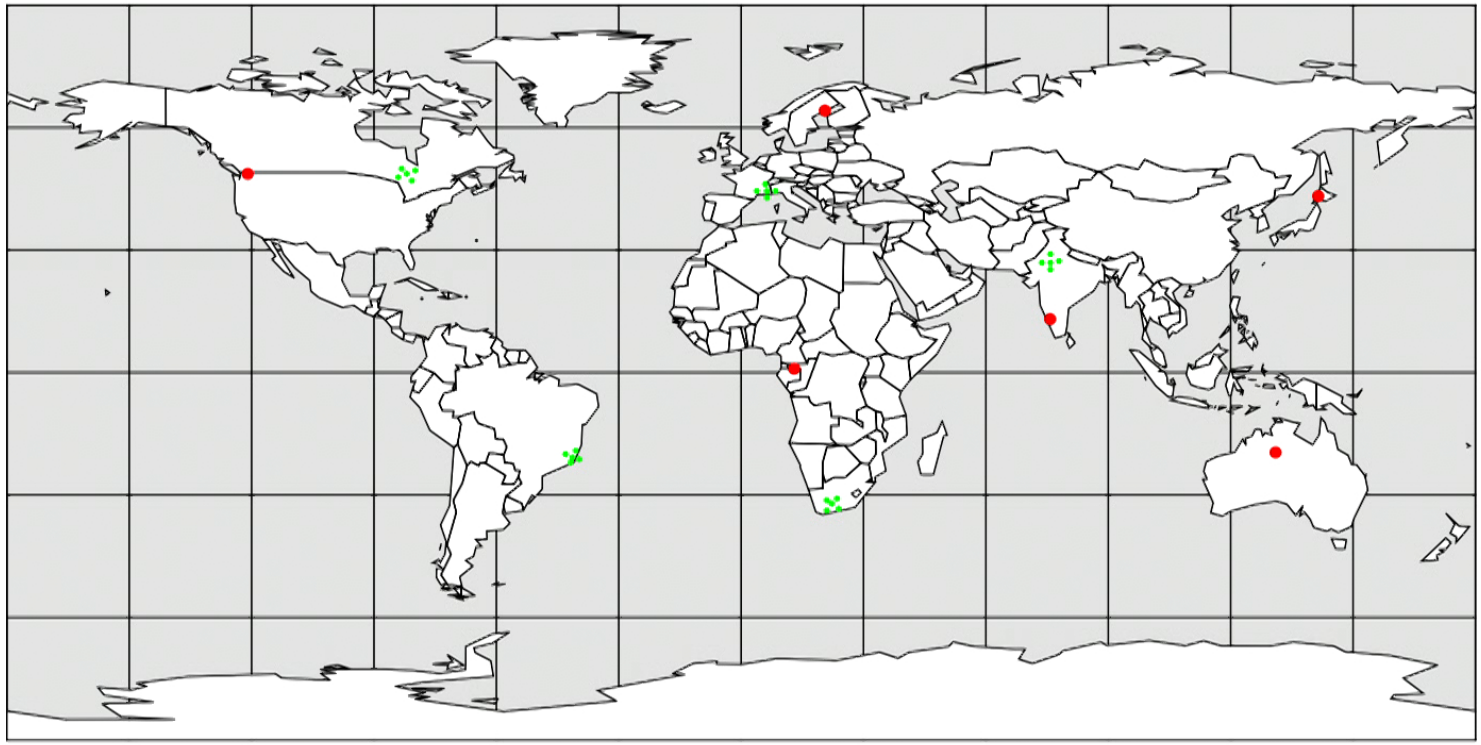
$$h^{ij} \hat{n}^{j} = 0$$

$$\mathrm{Tr}(h) = \mathrm{Det}(h) = 0?$$

$$A_{ij} = p_i p_j - q_i q_j$$

$$\tilde{A}_{ij} = \tilde{p}_i \tilde{p}_j - \tilde{q}_i \tilde{q}_j$$

$$A^{ij} \tilde{A}_{ij} = 0$$



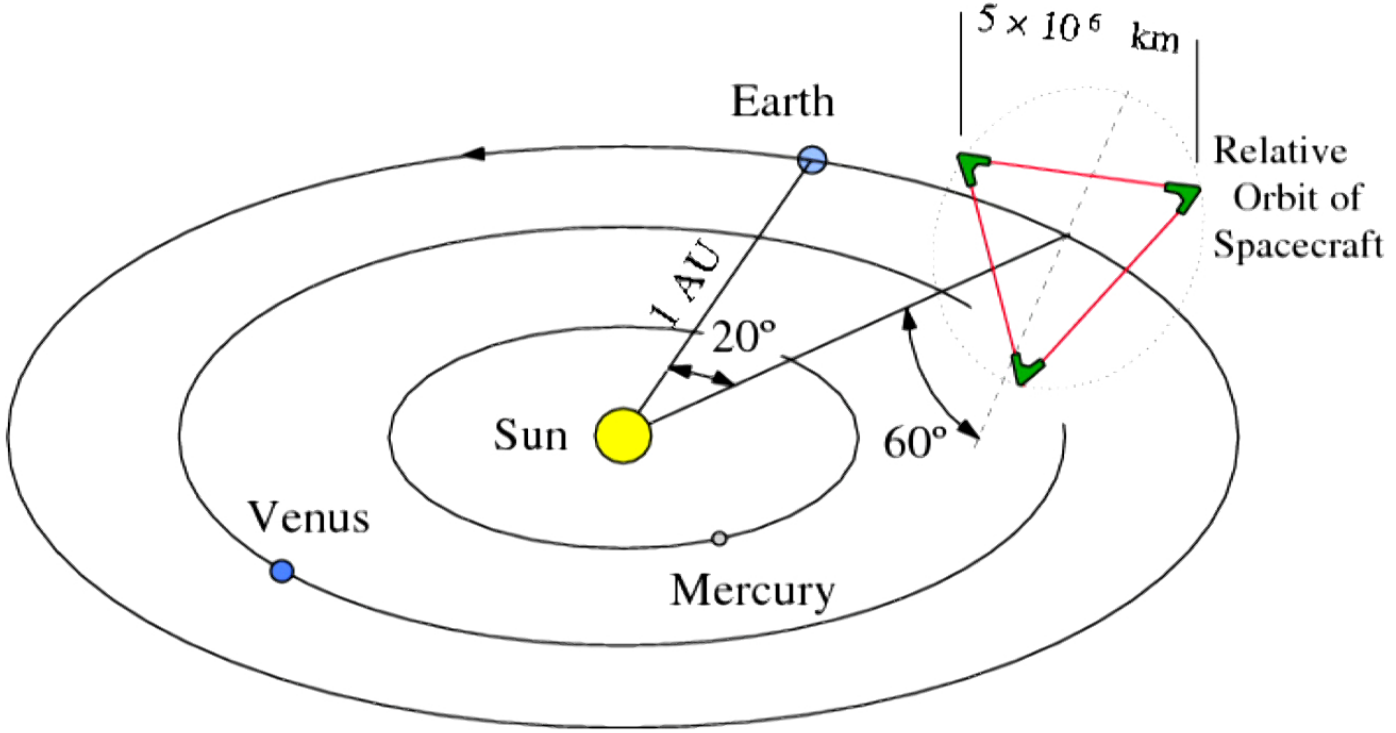
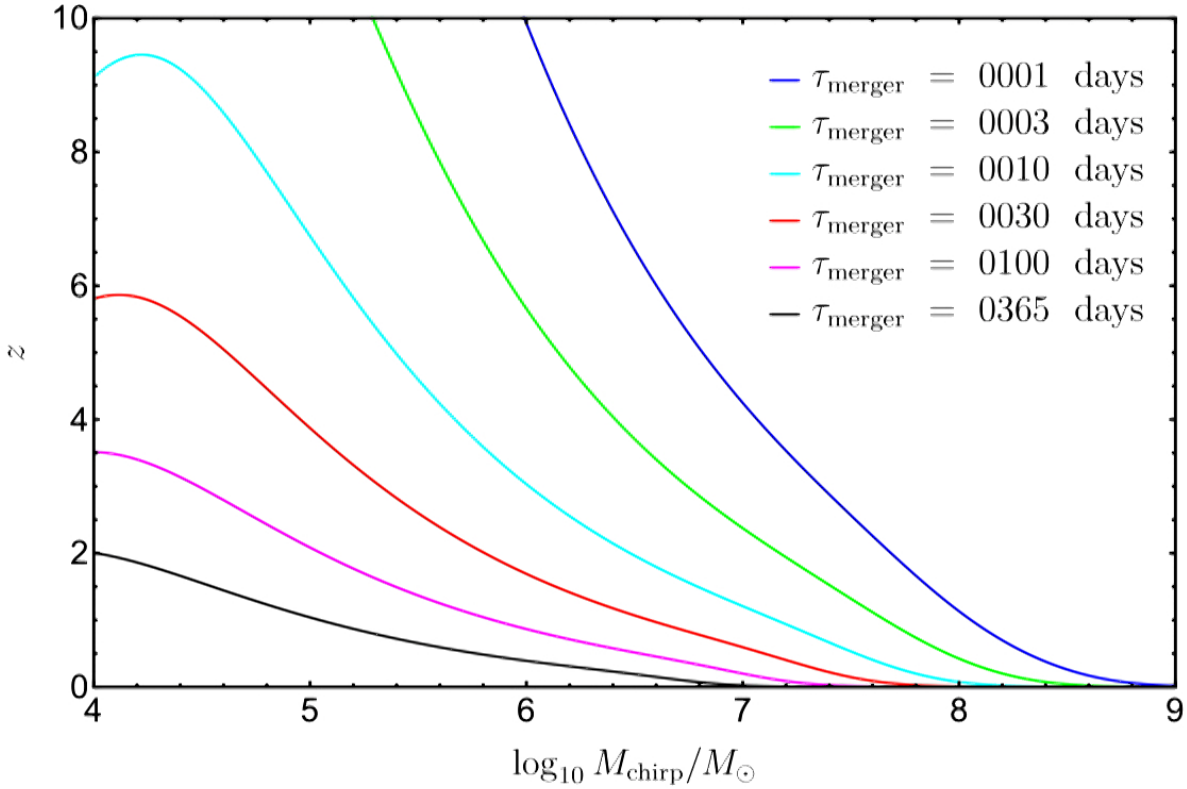


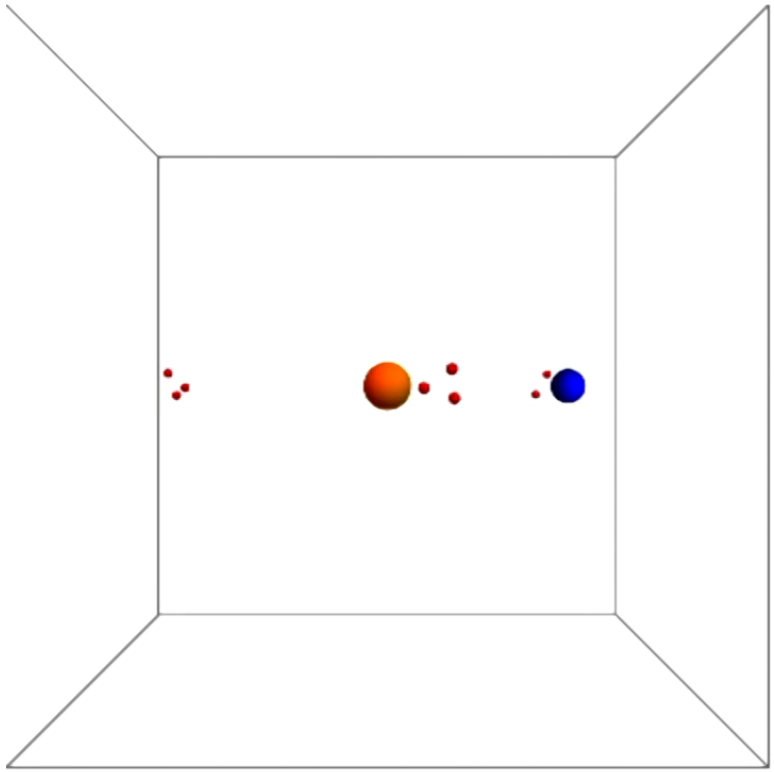
Figure credit: Sheila Rowan, Jim Hough

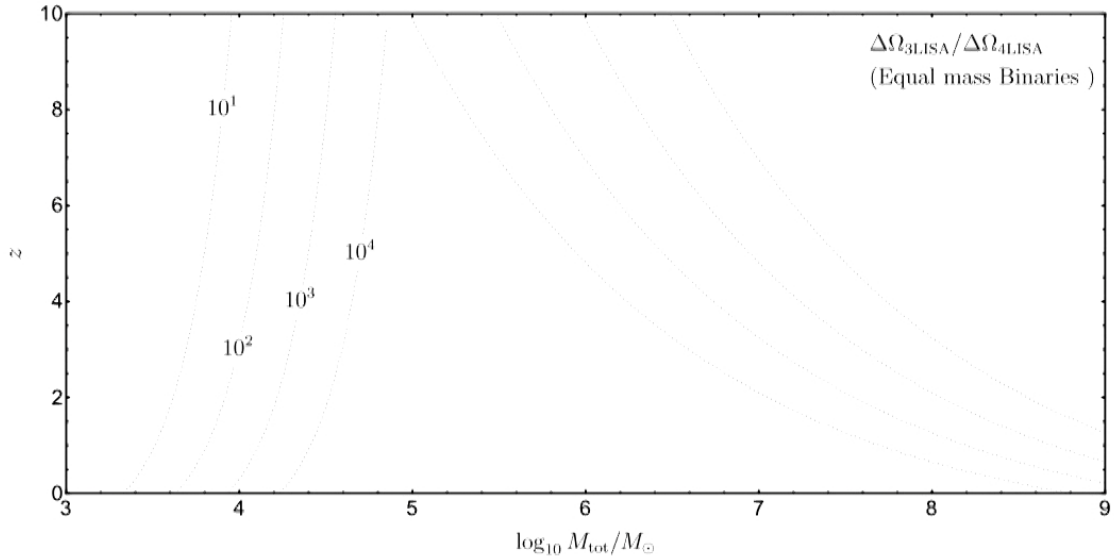

10
8
6
4
2
0
4
5
6
7
8
9
z
$\log_{10} M_{\rm chirp}/M_\odot$
$\tau_{\rm merger} = 0001$ days
$\tau_{\rm merger} = 0003$ days
$\tau_{\rm merger} = 0010$ days
$\tau_{\rm merger} = 0030$ days
$\tau_{\rm merger} = 0100$ days
$\tau_{\rm merger} = 0365$ days

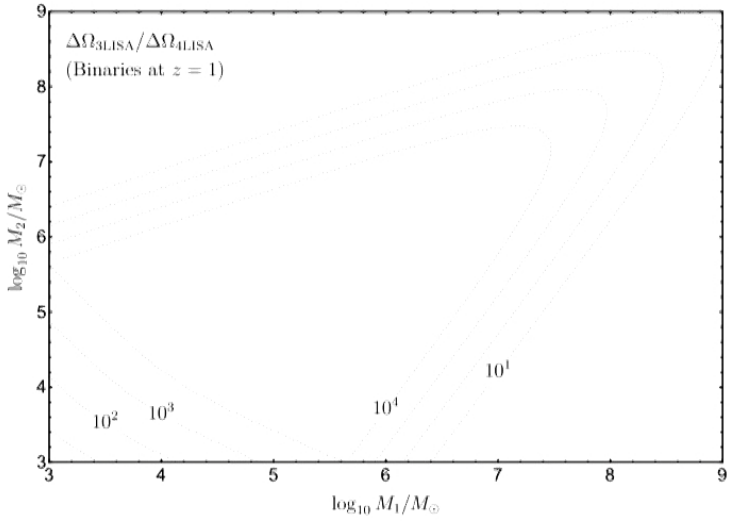
$$\Delta\theta_{\rm complete} \approx \frac{1}{\rm SNR}$$

$$\Delta\theta_{\rm LISA} \approx \frac{1}{\rm SNR}\frac{1\ {\rm yr}}{\tau}$$

Thrm: 4 satellites are complete, iff non-coplanar.




$\Delta\Omega_{3\mathrm{LISA}}/\Delta\Omega_{4\mathrm{LISA}}$
(Equal mass Binaries)
10^1
10^2
10^3
10^4
z
$\log_{10} M_{\mathrm{tot}}/M_\odot$


$\Delta\Omega_{3\mathrm{LISA}}/\Delta\Omega_{4\mathrm{LISA}}$
(Binaries at $z = 1$)
10^1
10^2
10^3
10^4
$\log_{10} M_2/M_\odot$
$\log_{10} M_1/M_\odot$

Thank you for listening!

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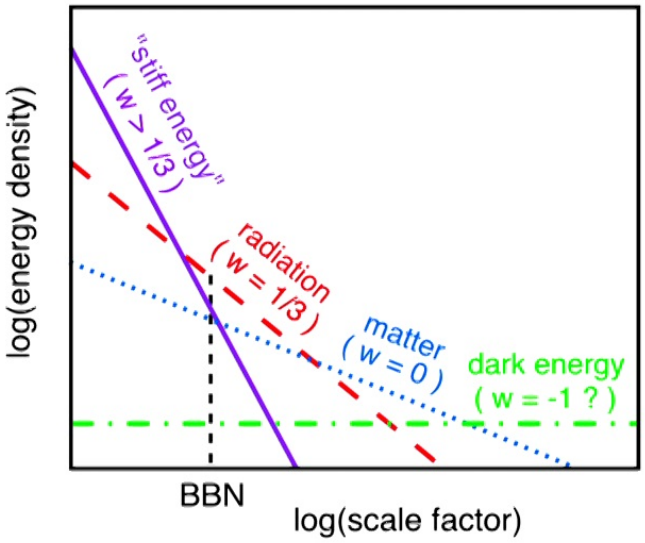

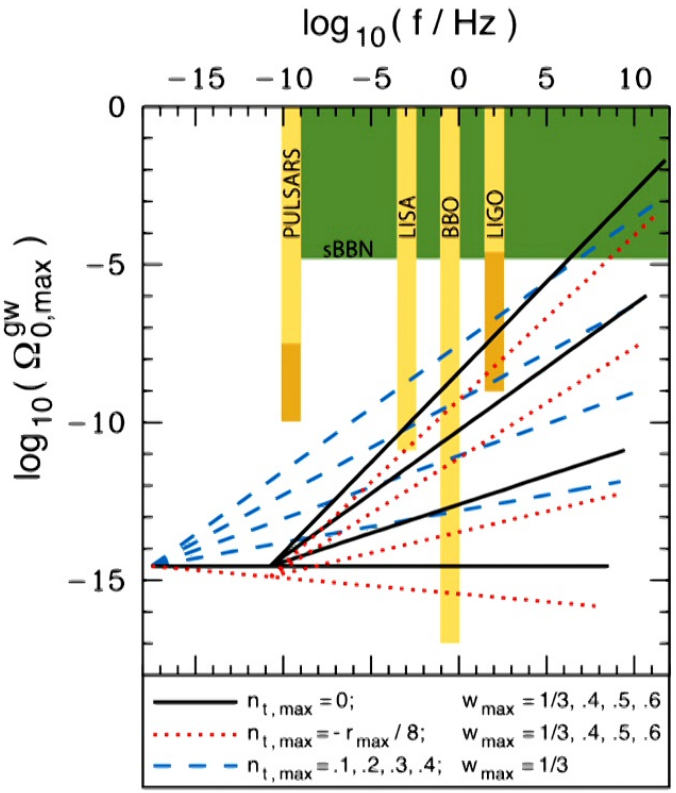

figures from L. Boyle and A. Buonanno, PRD (arXiv:0708.2279)